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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/410,737	10/01/1999	DELPHINE ANH DAO LE	169.1476	7371

5514 7590 10/17/2003

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NEW YORK, NY 10112

EXAMINER

LAROSE, COLIN M

ART UNIT	PAPER NUMBER
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2623

DATE MAILED: 10/17/2003

13

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/410,737

Applicant(s)

LE ET AL.

Examiner

Colin M. LaRose

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 July 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-67 is/are pending in the application.
- 4a) Of the above claim(s) 1-9,25-29,48-50,53,57-59 and 62 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 20-24,30-34,46,54,56,63,65 and 67 is/are allowed.
- 6) ☒ Claim(s) 10-12,15-19,35,39,40,43,45,47,51,52,55,60,61 and 64 is/are rejected.
- 7) ☒ Claim(s) 13,14,36-38,41,42,44 and 66 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Arguments and Amendments

1. Applicants' amendments and/or arguments filed 31 July 2003 (paper 12), have been entered and made of record.

Response to Amendments and Arguments

2. Applicant's arguments have been fully considered but they are not persuasive for at least the following reasons.

Regarding claims 10, 12, 35, 51, 52, 55, 60, 61, and 64, Applicant argues (p. 35) that Ikonmakis does not disclose comparing the seed pixel with a subset of neighboring pixels, since Ikonmakis compares the seed pixel to all 8 neighboring pixels.

Examiner does not believe that specifying a "subset" for comparison overcomes Ikonmakis. As was well-known, a subset is defined as "a set within a set". The subsets of a given set include (a) the null set, (b) the set itself, and (c) any combination of elements in the set, since (a), (b), and (c) are all contained in the set. Thus, the set of all 8 neighboring pixels is considered a subset of all 8 neighboring pixels.

Regarding claims 10, 35, 46, 51, 52, 55, 56, 60, 64, and 65, Applicant argues (p. 36) that Ikonmakis not does disclose updating "the property of the region that includes the appended pixel".

Examiner believes that Ikonmakis does disclose this limitation. In Ikonmakis' system, when a neighboring pixel is sufficiently similar to the seed pixel, it is appended to the seed

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pixel's region. "The region that includes the appended pixel" is interpreted as the appended pixel(s). In other words, the set of the appended pixel(s) comprise a region that includes the appended pixel. Ikonomakis clearly discloses updating this region (i.e. the appended pixel); when the pixel is appended, its value (i.e. "property") is updated to be the same as that of the seed pixel.

Regarding claims 35, 46, 55, 56, 64, and 65, Applicant argues (p. 37) that Ikonomakis does not disclose allocating pixels as seeds in areas as a function of luminance of pixels within those areas. Applicant submits that "the allocation of seeds in Ikonomakis is simply a function of what the next unassigned pixel in the image is following a predefined pattern for traversing the pixels".

Examiner disagrees with this assertion. Ikonomakis states (p. 299):

"Any of the neighboring pixels that satisfy a homogeneity function would be assigned to the first region and its pixel value would change to the seed pixel value. This neighbor comparison step would be repeated for every new pixel assigned to the first region until the region is completely bounded by the edge of the image or by pixels that do not satisfy the homogeneity function. The next seed pixel would be determined by choosing the first unassigned (to the previously grown region) pixel while moving through the image in a right-to-left and top-to-bottom fashion."

Thus, the next seed pixel is determined by choosing the first pixel that is not assigned to the current region. Said first pixel is chosen as a seed pixel because, based on its property (i.e. luminance), it was determined not to belong to the current region. Based on its luminance, the new seed pixel is identified in the immediate vicinity of a border between two regions.

Therefore, the seed pixels are "distributed in areas ... as a function of a property of said pixels

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within those areas”. That is, the difference in luminance between an unassigned pixel and neighboring assigned pixel(s) determines whether the unassigned pixel is identified, or distributed, as a seed pixel.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 10, 11, 35, 39, 51, 55, 60, and 64 are rejected under 35 U.S.C. 102(b) as being anticipated by “Region Growing and Region Merging Image Segmentation” by Ikonomakis et al. (“Ikonomakis”).

Regarding claims 10, 35, 51, 55, and 60, and 64 Ikonomakis discloses a method of segmenting an image comprising:

allocating pixels as seeds (column 2, page 299, lines 1+: start with a set of seed pixels);

and

growing regions from said seeds so as to segment the image into a number of regions (column 2, page 299, lines 2+: grow regions from the seeds),

wherein a subset of pixels that border said regions is considered (column 2, page 299, lines 7+: seed pixel is compared to its 8 neighbors, which, as explained above, comprises a subset of neighboring pixels) and that pixel of said subset that is most similar in a property to a region it borders is appended to that region and the property of the region that includes the

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appended pixel is updated (column 2, page 299, lines 8+: border pixels that satisfy a similarity function (including the most similar pixel) are appended to the region and changed to the seed pixel value) and said growing step is repeated until no pixels bordering the regions are available (column 2, page 299, lines 22+: growing step is repeated until no border pixels are left).

Further regarding claims 35, 55 and 64, Ikonomakis discloses allocating/distributing pixels as seeds in those areas of the image as a function of the luminance of the pixels within those areas (column 2, page 299, lines 5-22: a first seed pixel produces a first region of homogeneity, then a second pixel outside of the first region is specified as a second seed pixel, and subsequently produces a second region of homogeneity different from the first region; thus the seed pixels are allocated as a function of the luminance of homogeneous areas), wherein fewer seeds are allocated to those areas of the image having pixels of homogeneous luminance (each region is allocated only one seed; therefore, areas of the image having pixels of homogeneous luminance (i.e. encompass only one region) are allocated fewer seeds than those regions that are not homogeneous (i.e. encompass more than one region) and wherein said seeds form growing regions (i.e. each subsequent seed forms a new growing region).

Regarding claims 11 and 39, Ikonomakis discloses said property is the grey value (column 2, page 299, lines 25+: homogeneity function considers difference of grey levels).

Luminance is substantially equivalent to grey value.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claim 12, 15-18, 40, 43, 52, and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ikonomakis in view of "Seeded Region Growing" by Adams et al. ("Adams").

Regarding claims 12, 40, 52, and 61, Ikonomakis discloses a method of segmenting an image into regions, the image comprising a plurality of pixels, comprising:

allocating pixels as seeds (as in claim 10);

growing regions from the seeds, wherein the growing comprises:

scanning a subset of pixels that border the growing regions and determining for each border pixel, a value indicative of the similarity of a property of said scanned pixel and the corresponding property of a region that the border pixel borders (column 2, page 299, lines 7+: the eight pixels that border the seed pixel (which is in the growing region) are scanned and the similarity of the border pixels to the seed pixel in terms of luminance is determined by $|G - G_s|$);

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selecting a pixel that is most similar in the property to the region that said border pixel borders (column 2, page 299, lines 27+: a selected border pixel is appended to the growing region if it has a minimal difference value (this includes the most similar border pixel));

appending the selected pixel to said region bordered by the selected pixel (column 2, page 299, lines 10+: pixel is assigned to the region);

updating the said corresponding property of the region that includes the appended pixel (column 2, page 299, lines 9+: the luminance value of an appended pixel(s) (which comprises the appended region) is changed to the seed pixel value); and

repeating the growing steps until there are no more border pixels (column 2, page 299, lines 23+: growing steps are repeated until no border pixels are left).

Ikonomakis does not expressly disclose generating a list of the border pixels and scanning the pixels of the generated list.

Adams discloses a similar region-growing method for segmenting images that comprises generating a sequentially sorted list, or SSL, which contains neighboring pixels of growing regions (column 2, page 642, lines 12+). Neighboring pixels are stored in the list according to their similarity measures. The list is scanned in a predetermined manner, and pixels are removed until the list is empty.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Ikonomakis by Adams to generate a list of border pixels and scan the pixels of the list as claimed since Adams shows that utilizing a linked list of pixel addresses facilitates the labeling of boundary pixels into the their corresponding regions.

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Regarding claim 15, Ikonomakis discloses said property is the grey value (column 2, page 299, lines 25+: homogeneity function considers difference of grey levels).

Regarding claim 16, Adams teaches the claimed similarity measure (equation 1, page 642).

Regarding claim 17, Ikonomakis discloses the said value is determined in accordance with a metric in color space (equation 1, page 300).

Regarding claim 18, Ikonomakis discloses merging the grown regions which have similarities (column 1, page 300, lines 21+: after growing, merging is done).

Regarding claim 43, Ikonomakis discloses merging neighboring regions as claimed (column 2, page 299, lines 21+).

8. Claims 19, 45, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ikonomakis and Adams in view of “Image Segmentation and Approximation Through Surface Type Labelling and Region Merging” by Lim et al. (“Lim”).

Regarding claims 19 and 45, Ikonomakis discloses
determining for each pair of neighboring grown regions a clique function value
representative of the similarity of said property of said pair of neighboring grown regions; and
merging a pair of regions to produce a merged region if the clique function is less than a
predetermined threshold (column 1, page 300, lines 32+: homogeneity (clique) function between
neighboring regions and a merging threshold is used to merge regions whose value is less than
the threshold – this includes the selection of the regions with the smallest clique function value

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and the comparison of their clique values to the threshold to determine if the regions should be merged).

Ikonomakis does not expressly disclose updating the merged regions' clique functions.

Lim discloses a similar method for merging segmented regions. Lim teaches selecting the region with the lowest measure of dissimilarity and repeatedly merging each subsequent selected region on the condition that the measure of dissimilarity does not exceed an error threshold value (column 1, page 1381, paragraph 5). Also, when two regions are merged, the measures of dissimilarity between the new region and its neighbors are updated.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the merging sub-steps of Ikonomakis by Lim to achieve the claimed invention since Lim teaches that the claimed merging sub-steps have good performance, a lower approximation error, and a reduced processing time (column 2, page 1381, paragraph 1).

Regarding claim 47, Ikonomakis discloses merging neighboring regions as claimed (column 2, page 299, lines 21+).

Allowable Subject Matter

9. Claims 13, 14, 36-38, 41, 42, 44, and 66 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
10. Claims 20-24, 30-34, 46, 54, 56, 63, 65, and 67 are allowable.

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Regarding claims 14, 20, 42, 46, 56, and 65, neither Ikonomakis nor Adams discloses using, for scanning the list of pixels, a step size that is a function of the length of the list, as claimed.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colin M. LaRose whose telephone number is (703) 306-3489. The examiner can normally be reached Monday through Thursday from 8:00 to 5:30. The examiner can also be reached on alternate Fridays.

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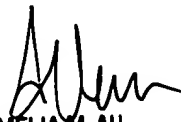
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au, can be reached on (703) 308-6604. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the TC 2600 Customer Service Office whose telephone number is (703) 306-0377.

CML

Group Art Unit 2623

6 October 2003


AMELIA M. AU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600